Original Research Article

Assimilating the Responsible Factors for the Technical Efficiency of Organic Brown Sugar Production: Stochastic Frontier Approach

Abstract

The growing demand of organic brown sugar has increased recent years and there is a potentiality to improve output by making strategic use of existing knowledge by the responders.The aim was set to measure the feasibility of brown sugar production with a special interest on technical efficiency targeting the marginal cane farmer. The research examines technical efficiency of the sugarcane farmers who are simultaneously involved in the processing of organic brown sugar in a particular area in Bangladesh. Purposive sampling was used to collect 163 farm data during September to December 2021 and then stochastic frontier production function was tactfully ascertained for the approximation of the technical efficiency of targeted brown sugar producers.Present study fallouts the technical efficiency scaled from 49.94 to 98.38 percent with a mean value of 84.5%. So, there is a crucial possibility of improving the yield up to 15.5% through better crop management practices. Farmers with extensive experience, education, and training turn into technically more efficient. Although almost 68% farmer receives extension services but that assistance does not bring out the considerable efficiency level of the farm units.

***Key Words**: Productivity, Sugarcane, Indigenous, Inefficiency.*

1.Introduction

Being ancient annual crop, sugarcane has become one of the momentous cash cum industrial crop in the country. The best utilization of farmer's sugarcane is to make sugar from it other than sale it directly. Brown sugar is a product of the processedsugarcane.In order to diversify the sugar market, the production of organic brown sugar has a growing demand in both home and international market. Farmers, who are interested in maximizing their revenue from the sale of their sugar cane, have another option in the form of brown sugar[1]. In the study area, sugarcane is produced by lots offarmers and they make brown sugar in a traditional way from their produced sugarcane. Brown sugar is one kind ofsucrose that has a different color due to themolasses and it (non-centrifugal cane sugar) is quite popular due to the pleasurable fragrance that is reminiscent of caramel and also for its sugariness[2].This kind of soft sugar can be totally unprocessed or some extent processed; made of sugar crystal or it sometimes made up by amalgamating molasses with rectified white sugar. This item is considered rich in nutrition and also indigenous dehydration process was thoroughly followed[3].

Table 1: Nutritional Value of Brown Sugar (Sucrose with Molasses) per 100 g

Energy (377 Calories)	Quantity	% Daily Values*
Total Fat	0 g	0 %
Saturated Fat	0 g	0 %
Trans Fat		
Polyunsaturated Fat	0 g	
Monounsaturated Fat	0 g	
Cholesterol	0 mg	0 %
Sodium	39 mg	2 %
Total Carbohydrate	97.33 g	35 %
Dietary Fiber	0 g	0 %

Sugars	96.21 g	
Protein	0 g	
Vitamin D		
Calcium	85 mg	7 %
Iron	1.91 mg	11%
Potassium	346 mg	7 %
Vitamin A	0 mcg	0 %
Vitamin C	0 mg	0 %

* % Daily Value (DV) tells how much a nutrient in a serving of food contributes to a daily diet. 2000 calories a day is used for general nutrition advice.

Source: FatSecret Platform API

The usage of brown sugar is distinct from that of white crystal sugar due to the fact that brown sugar imparts a taste similar to that of sweet caramel, which is absent in white sugar. As a result, brown sugar plays a distinct function in the preparation of sweet food [4]. Brown sugar is regarded first than white sugar as it improves blood flow and also amplifies blood cell production which renders more minerals and nutrition although it depends on its different processing systems. When comparing the quality of natural brown sugar to that of commercial brown sugar, which is derived through various manufacturing techniques and usage of raw materials, one may find that human health is experiencing distinct convenience and threat [5]. So, being indigenous brown sugar is more affordable and safer for daily intake. The calorie intake of per 100g of brown sugar consumption contains 377 calories (Table 1) [6]. 100g of brown sugar contains 7% of both potassium and calcium respectively and 11% of the Daily Value for iron, with no other vitamins or minerals in significant content. However, due to its smaller crystal size, brown sugar packs are thicker than white sugar and could have more calories when assessed in terms of volume.

We have historically used to sugar items common is daily consumption; in sweetening dishes. But the production of brown sugar is geared by the population of individuals whose dietary practices prioritize the elimination or reduction of the use of chemical products throughout the sugar processing stage[7]. So, if supplied with guaranteed eminence and essence, the demand for red sugar (local name of brown sugar) will be highly appreciated because peoples are now more health conscious. Two different categories of brown sugar are widely seen: one of that is made locally, straight from the cane extracted juice, and another is made at the time of the processing of raw sugar. The refined brown sugars are produced sugar from factories which are capital intensive. The local production is popular for its cost saving nature and apt for tiny farm units. But to be successful in this small-scale business a highly experience, aptitude, and expertise is also the prerequisite for the survival of the traditional farmer. Also, in the manufacture of brown sugar, the case of technology that is efficient with energy use may enhance the approach of using fuel proficiently, the number of job possibilities, and the income of rural communities while supporting the preservation of agrarian land and woodland[8].

Only in the study area, farmers produce handmade brown sugar as they still have a tradition to preserve their ancient profession among Bangladesh. Although they make brown sugar with a small-scale production and sell their product in local market but their share of production has an increasing trend over time.

Measuring the efficiency of firms is a tactful means of estimating performance of firms. A firm becomes technically efficient only when it can bring out the optimum produce from operating at a least quantity of efforts it has.

Table 2: Yield of Brown Sugar in Study Area (Fulbaria, Mymensingh)

Year	Area of Sugarcane Production (ha)	Brown sugar Production (tons)
2016	1250	6839
2017	1255	6393
2018	1280	7082
2019	1280	6746
2020	1285	6746
2021	1285	6682

Source: field survey, 2021

Now-a-days production and resource use efficiency in the farming sector has started to seize an important place in agricultural policy frameworks which seeks to raise domestic production by inspiring optimal resource utilization where it is an important issue to see technical efficiency of production process.Flourishing technical efficiency is a significant issue of yield raise and is more suitable in Bangladesh because of limited resources and where production is not increased through improved efficiency by either boosting existing source or evolving different expertise.Arru[9]in her study predicted that the margins for enhancing the efficiency of recreational services are bigger than those of other services, and various technological aspects subsidize to the technical efficiency of varying degrees. In the study area, over the years cane cultivation is considered a means of living for the unprivileged rural people although input used for sugarcane production such as fertilizer, labor is not optimally available because of high price and scarcity. Also, the farmer lacks technicalacquaintance and extension services. So, the production sometimes disappointed farmers. In thatcaseof achieving sugar self-sufficiency which has been proved sometime unsuccessful thus far demonstrates that the sugarcane sector has to find alternatives in order to satisfy the demand for sugar at the nationwide [10].

The refining of cane into brown sugar was carried out in huts located near the field of sugarcane. Sugar cane in the study area was processed traditionally using traditional things. They sell their brown sugar only to Paiker or wholesalers and sometimes to their native ones. They do not get their appropriate price for their product. The wholesalers sell the brown sugar only to local market. So, this nutritious brown sugar is used only by some people. So, if the production can be increased with the efficient use of resources and processing of sugar can be done by modern way, then the farmers can produce the ultimate brown sugar easily. Thus, the production of brown sugar can contribute to local demand with other places of the country which also contribute to the economy of the country. This investigation in depth was conducted in order to detect the efficiency measures of the brown sugar respondent.

2.Materials and Methods

The primary data of 163 farm unitwas assessed to obtain detailed information on various aspects of brown sugar production during the period of September to December 2021. The study targeted five villages from Fulbariaupazila in Mymensingh: Asim, Kaladaha, Biddanonda, Valukjan, and Polashtoli, owing to the area's year-round sugarcane farm availability. Only 163 units were selected purposively because in the study year the whole world faced a pandemic situation for covid-19. So, it was difficult to interview people as all the concerned people were traumatized for the pandemic.

The assembled and pre-determine data from the social perspective of the study was critically scrutinized via the software programs named Stata -16 and Frontier 4.1. Among them widespread descriptive statistics of brown sugar production were usedin the course ofcheck out and narrating the input variablespredominantlylike brown sugar production, hired labor, fertilizer, seeds and pesticides application by the respective units.

2.1 Econometric Analysis

The technical efficacy of brown sugar production in the research area was calculated following the process of stochastic frontier production model. The model is suited in this situation because the stochastic frontier method may be used to describe the divergences in real production from the frontier originates bytheineptitude and random distress, where the ineptitudearises by the incompetentpractice of scarce resources [11].

The best suitable frontier model in the current study is specified as follows:

$Y_a = f(X_a; \beta) \exp(V_a - U_a)$ wherea = 1, 2, ………., n ……………. (1)

where $Y_a$represents the output of a^{th} farm unit; X_a is an input parameter appointed to produce Y; β refersatechnologyparameterthatneeds estimation; $V_a$denotes the disturbanceandpresumed to be dispersed as N (0, σ_u^2). The$U_i$termedasthe model's technical inefficiency accompanying with its non-negative values and bothof its uniform and autonomousspreadcurtails at zero of the normal distribution [12].

The proposed inefficiency model is,

$u_a = \delta_0 + \sum^{n}_{a=1}\delta_a Z_a$

where, $Z_a$embodies the aspect of socio-orient variables and $\delta_0$denotesingredient of strange coefficients of the farm-oriented inefficiency variables [13]

TheTE of andistinct farm unit is preciselyarticulated as:

$TE = Y_a / Y_a^*$

TE= f (X_a; β) exp (V_a – U_a) / f(X_a; β) exp (V_a)……………(2)

Additionally, the results from the Cobb-Douglas elasticities could be comparable to all those produced from the trans-log specification at the sample mean [14]. Followed by the trend, a Cobb-Douglas production function was ascertained for brown sugar production.

$Y_i = \beta \Pi^n_{b=1} X_{ab}^{\beta j} e^{\varepsilon a}$……………………………….(3)

where, $\varepsilon_a = \upsilon_a – u_a$. and a is used to index farms and b is used to index inputs.

$\ln Y_a = \beta_0 + \beta_b \sum^n_{b=1} X_{ab} + \upsilon_a – u_a$…………………..(4)

The following definition of the technical efficiency index is used since the frontier production function is stated in logarithmic form: [12].

$TE_a = \exp(-u_a)$ ……………..……………………….. (5)

moreover, to use (5), it is necessary to isolate technical inefficiency from statistical noise in the compound disturbance term. (υ_a - u_a). The probability distribution that comes from the subgroup of u is used to calculate the assesment of u for each unique observation in the sample., given ε (ε = υ - u):

$E(u|\varepsilon) = \int^0_{-\infty} u\, f(u|\varepsilon)\, du$ ……………………….(6)

where f (u |ε)termed as standard normal density function. Jondrow[15] showed that

$E(u|\varepsilon) = \sigma_u \sigma_v / \sigma \{ f(\varepsilon\lambda/\sigma)/1 - F(\varepsilon\lambda/\sigma) – (\varepsilon\lambda/\sigma) \}$…………………..(7)

where, F(ελ/σ) is the standard normal distribution function, $\sigma^2 = \sigma_u^2 + \sigma_v^2$, and $\lambda = \sigma_u / \sigma_v$. The following formulation is used to obtain the allotment for each specific competence index: f (ελ/σ) and F(ελ/σ) evaluated at (ελ/σ). After the estimation of ε, λ and σ all these values again appeared to rate the density and distribution functions.

$TE_a = \exp\{E(u_a | \varepsilon_a)\}$ …..……………………….... (8)

2.1.1 Empirical Model

The specificappearance of stochastic frontier model written as follows:

$$Y = \beta_0 X_1\beta_1 X_2\beta_2 \ldots X_7\beta_7 e^{Va-Ua}$$

The aforementioned function is in double-log linear form.:

$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + V_a - U_a$

Similarly, as it is a significant source of inefficiency, utilizing the variates of the inefficiency function to evaluate the possessions based on the model [12] was specified as:

$Ui = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + W_a$

δ_1, ... δ_5 unidentified variables requiring estimation. To determine the parametric numerical values of the stochastic frontier function and alsotechnical inefficiency, the program Frontier 4.1 was utilized [16]. Broadly the equation can be written as for the study area is below

$U_a = \delta_0 + \delta_1$ Age+ δ_2 Education + δ_3 Sugarcane farming experience + δ_4 Extension service + δ_5 Training + W_a

Where, W_a is two-sided uniform variable that is positively distributed. The simultaneous estimation of this recent developed model is using statistical package STATA version 16.

The variance parameters must be calculated along with the coefficients of the unknown parameters and which are expressed in terms of,

$$\sigma^2 = \sigma_u^2 + \sigma_v^2 \text{ and } \gamma = \sigma_u^2 / \sigma^2$$

The $0 \le \gamma \le 1$ interpreted as the critical measure of γ which has a recumbent limit between 0 and 1.

3. Results of the Study

3.1 Socio-demographic Status of Brown Sugar Farmers

Table 3 demonstrates the social demographic cultures of selected brown sugar respondentstodescribe their fundamental information thatillustratesand stimulates the progressive behavior of those respondents.

Table 3. Sociodemographic snapshot of sugarcane growing farmers

Variables	Category	Score range	Frequency	Percentage
Age	Young	25-35	41	25.25
	Middle	36-50	65	39.88
	Old	51-above	57	34.97
Education	Illiterate	0	67	41.10
	Primary	1-5	46	47.92
	Secondary	6-10	38	39.58
	Higher Secondary	11-12	4	4.17
	Above HSC		8	8.33
Family Size	Small	1-5	95	58.28
	Medium	6-10	66	40.49
	Large	Above 10	2	1.23
Experience	Low	1-15	96	58.90
	Medium	16-30	50	30.67
	High	Above 30	17	10.43
Training Facilities	Training Received	1	117	71.78
	No Training	0	46	28.22
Extension Services	Services Received	1	111	68.09
	No Service	0	52	31.91

As shown, 41% of the sampled farmers evicted to be illiterate, while only 8.33% of them embraced a higher education. Alongside, more than half of the participants illuminated a farming experience beyond 16 years as most of their age ranged from 36-50 years old. While being interrogated about receiving training and extension service most of the respondent higher than 50% of total sample avouched to receive it.

Table 4 exhibits all the input output measurementsvariables of cane farmers that wereestimated by simple statistical tools. The output of brown sugar in the particular research area was 4839.75 kg which is grown from on an average 10205.21 number of saplings. The average quantity of fertilizer that was required to produce is 916.32 kg. On an average 11563.19 Tk/ha is required to prepare the land. In the study area the production requires huge water supply through irrigation at a regular interval during the entire season equivalent to average 27751.656 Tk of the total cost. Average human labor was 507-man days indicating sugarcane production as a labor-intensive crop. This outcome corroborated [1] as they found 72.2% workers share on in each kilogram of brown sugar. Normally the average insecticides used per hectare was 63.061 kg.

Table 4. Abridged statistics of the variables

Variables	Description of Variables	Mean
Output and Input Variables		
Y	Total Brown Sugar Production (kg/ha)	4839.75
X_1	Land in hectares	0.16
X_2	Human Labor (man/days)	507.75
X_3	Land Preparation Cost(tk./ha)	11563.19
X_4	Irrigation Cost (tk./ha)	27751.66
X_5	Number of sapling/ha	10205.22
X_6	Fertilizer in kg/ha	916.32
X_7	Insecticides in kg/ha	63.06
Farm Specific Variables		

Z_1	Age in Years	46.10
Z_2	Educationin Score	4.50
Z_3	Experience in Years	15.91
Z_4	Extension Services (=1 if received, 0 otherwise)	0.68
Z_5	Training Facilities (=1 if received, 0 otherwise)	0.72

The average working personnel age found 46 years with a ranging between 25 to 50 years. The minimum institutional educational attainment of the respond farmers found 4.503 years of the primary level. The farmers are well acquainted with their traditional method as the area has an average 15 years of experience of the research area. The mean frequency of catch up with extension workers and training facilities was 68 % and 71%.

3.2 Technical Efficiency of the Brown Sugar Farmers

The examination of TE is necessary in the field of sustainability studies due to the fact that TE places an emphasis on the decisions made by farmers, who are, in the end, the most significant factor in ensuring the economic viability of a region[17] [18].In the context of TE, the "production frontier" functions as one example of such a standard. TE may be termed as the capacity and inclination of a farm unit to acquire the greatest potential output with a particular bequest of inputs. This is the maximum output that can be obtained with the inputs that are available.

3.2.1. SFP Model Diagnosis Through Maximum LikelihoodEstimates

Individual efficiency levels in sugarcane producing farm units were measured using the stochastic frontier production function. One of the commonly employed formula to perceive the presence of multicollinearity among explanatory variables was the VIF testing. The VIF values of all variables entered in to the model were below ten which is an indicator for the absence of severe multi-collinearity among the proposed explanatory variables. The variance parameters for sigma square and gamma were found significant by 0.33947 and 0.729471 respectively. The gamma postulates the coherent pressure of the residuals by the production function which is the ultimate mainspring of disturbance [19]. The estimate of γ= 0.729471 or 72.94 percent of the inefficiency effects has a considerable influence on the incompetence of sugarcane producers. That means 72.94% of the differences found in the production of sugarcane; because of the discrepancies of technical efficiency. So, there is a potential to raise efficiency level by changing the existing level of production technology. Table 5 reveals that if farmer produce with large land area, they can reduce their cost of production by 0.0061% which makes them efficient producer. Labor coefficient insignificancy stimulates the sugarcane outcome because of extreme use of labor raises the production cost which in turn downfall the profit.

Table 5. Parameter estimation of cobb douglasstochasticfrontier analyses

Parameters	Variables	Coefficient	standard-error	t- ratio
β_0	Constant	10.230	1.0579	9.67*
β_1	Lnland	0.0061	0.0024	2.49**
β_2	Lnlabor	-0.0316	0.0336	-0.94
β_3	Lntractor	-0.2331	0.0774	-3.01*
β_4	Lnirrigation	0.0467	0.0242	1.97**
β_5	Lnseed	0.0755	0.0434	1.74***
β_6	Lnfertilzer	0.0695	0.0320	2.17**
B_7	Lninsecticide	-0.0123	0.0241	-0.51
Sigma squared		0.33947	0.04277	7.936***
γ		0.72947	0.03105	23.491
Log likelihood			194.8173	
LR test of the one-sided error			4.232057	

***significant at 1%; **significant at 5%; *significant at 10%

The standardized figure from the land formulation cost were -0.2331, spending more on this factor decrease possible output loss to sugarcane by 23.31 percent. In the study area, farmer produces with small farm area. If they spend more on land preparation, it increases their cost which reduces other spending on other input. So, it affects the production. At the initial stage of sugarcane production irrigation acts as an important input to survive the setts of the sugarcane in the new field. The spending on irrigation while increased per unit production of sugarcane would be raised by 4.67 percent. In the study area because offarmers are poor and have deficiency in the capitalinvestmentfor production, they imbeddednot enough seeds. So, if there was a possibility to raise the rate, sugarcane production would be increased by 7.55 percent. Fertilizer is an important factor as it increases soil nutrient and makes the sugarcane plant healthy and vigorous. It is a very common practice of increasing production. Here fertilizer also had statistically significant effect on sugarcane cultivation which increases the yield by 6.95%.The insecticide costing found irrelevant having seldom affect on the production in turn makes an advantage for the farmers to reduce insecticide cost from their cost item.

3.2.2 Interpretation of Technical Inefficiency Model

Results from the technical inefficiency effect model (Table 6) farm expertise, education and training postulates the anticipated (negative) values. Farmers with more experienceare strictly have additional competent than other one although the calculated values of experience dictate its significances at 5%.

Table 6: MLE estimates for the parameters of SFA for technical inefficiency model

Parameters	Inefficiency variables	Coefficient	standard-error	t- ratio
δ_0	Constant	-69.8579	3491.395	-0.02
δ_1	Age	0.1998	0.1611	1.24
δ_2	Education	-0.2050	0.3361	-0.61
δ_3	Experience	-0.2648	0.1156	-2.29**
δ_4	Extension Service	0.01956	1.0349	0.0189
δ_5	Training	-0.01353	0.0073	-1.85*

***= significant at 1%; **= significant at 5%; *= significant at 10%

The average functional value of education was negative with the value of 0.2050 though the coefficient was not statistically significant postulates that producers with higher education turn out to be capable compare to uneducated producer. The negatively significant (1 percent) coefficient of training implies that trained producer was basically extra effectual compare to who have no training. The coefficient of age is positive that means younger farmer are more effective than older farmers. It can be seen because younger farmers are literate, so they have knowledge about modern agriculture and can overcome easily if any problem they find in production process. The coefficient of extension services is also positive which implies that if extension services increases, inefficiency is also increases. This can be happened in the study area as many farmers are seen who write or read only, they do not care about extension services and do not understand their advice about modern agriculture. Here, the coefficients of age and extension services were not statistically important. Hence, all the above stated factors are remains impartial in case of the inefficiency of making brown sugar.

3.2.3Technical Efficiency and Its Distribution

Table 7express frequency dispersal of farm-oriented technical efficiency for sugarcane farmers and84.49 percent TE were assessed for brown sugar. About 47.24 percent of respondent were constituted to accommodateharveststhat were adjacent to the frontier outputs upholding the efficacylevelupper than 91 percent. On the contrary, the next peakshareconstituted about 18.40%attained 81-90 percent technical efficiency level. Even the lowest percentageof 1.23 touched 41-50 percent efficacy. The paramount range of this current technical efficiency constitutes the maximallevelof 98.38% where the marginal was 49.93% correspondingly.

Table 7: Frequency distribution of technical efficiency

No	Efficiency Range	Frequency	%
1	91-100	77	47.24
2	81-90	30	18.40
3	71-80	27	16.56
4	61-70	20	12.27
5	51-60	7	4.29
6	41-50	2	1.23
Maximum Level of TE	98.38%		
Mean Average	84.49%		
Minimum Level of TE	49.93%		

4. Discussion

Here, the study deals with technical efficiency of brown sugar production in a particularupazila under Mymensingh district of Bangladesh. Because of the higher availibility of sugarcane farmon that targeted area with round the year due to favorable climatic condition five villages namely Asim, Kaladaha, Biddanonda, Valukjan, Polashtoli, under Fulbariaupazila in Mymensingh were ascertain for the investigation.

Fulbariaupazila in Mymensingh district is certainly an exception because the farmers here decoct the cane extract and strained it sticking with an aboriginal process of preparing red sugar, not the molasses. The method here used to produce brown sugar was practiced since the primitive time of far away from the concept of sugar mill.The farmers of Fulbaria are still using it and this process is nowhere to be found around the country right now.

Brown sugar manufacturing becomes much less efficient as a direct result of inaccurately allocating its inputs, which is one of the factors. In this context, there is the prospect of raising production either by using cutting-edge technology or by enhancing the operational effectiveness of farmers, or both.The age and level of expertise are the primary external variables that influence the level of productivity achieved in the preparation of brown sugar [20]. But in our study among the entire sample one hundred percent of the farmers were male headed and maximum farmer discovered under the range of most productive age, still there was inefficiency. The study reveals efficiency comes from the experienced and trained farmers who do their job such a way that get determined output from the existing input. The experienced farmers are more competent than other farmers as long experience bring the attainment of expertise in doing the same work over a period of time. The trained ones are more skilled farmersas because of the technical knowledge gap between them. Surprisingly, our findings indicate that the extension service seldom enhance the efficacy level, despite the fact that, according to the majority of the research in the field, greater levels of extension service are often linked with better TE scores [21]. The average estimated technical efficiency results for the current study presagedthatthe production could be increased further easilywithout any further cost.

As considered being a long living crop, sugarcane's irrigation and nutritional requirements are high. Present study also found fertilizer and irrigation extremely high level of significance. Sugarcane productivity will be increased with the use of these two variables (Table 5). The result also points out to increase the number of seed and farm size to keep up the potential output. The land preparation cost was significantly negative as it consumes noteworthy portion compare to total cost and if the cost increases, it will intern affects the production inversely. The coefficient of insecticides was negative and insignificant.

Many challenges plagued farmers as they attempted to cultivate sugarcane. The key issues encountered by sugarcane growers were the fluctuations between input and output price, a lack of scientific understanding, training, extension service, quality setts, a lack of finance, and wasteful waste of sugarcane. Unskilled workers, a shortage of available workers, and excessive input costs are also factors. For the purpose of increased sugarcane harvests, the government and other NGOs should work to mitigate or eradicate these issues.

5. Conclusion

Sugarcane is the fourth cash cum industrial crop in Bangladesh. Here, average projected TE of brown sugar production resulted 84.49% specifying potential lacking by 16.51 percent. The estimated deviancy for sigma square and gamma were 0.33947 and 0.7294 particularly has showed the moderate level of inefficiency. Thereisanincredible potential for sugarcane cultivation. The observation indicates social condition of respondents can be improved by producing brown sugar from sugarcane. However, the falling trend of landarea,makeittough to raise the production horizontally in Bangladesh. Through proper utilization of the prevailing know-how the output can be improved.Because of the respondent's lack of experience, illiteracy, lack of training, low extension services they proved inefficient.Targeting its possible demand inclusive research collaboration needs to be built to sustain the upcoming aspirational issues of brown sugar production.

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